DIRECTIONS

FOR OBTAINING, BOTH

POSITIVE AND NEGATIVE

PICTURES UPON GLASS

BY MEANS OF THE

COLLODION PROCESS,

AND FOR

PRINTING FROM THE NEGATIVE GLASSES ON TO PAPER.

BY

T. H. HENNAH.

ALSO,

GUSTAVE LE GRAY'S

RECENTLY PUBLISHED METHOD OF OBTAINING

BLACK & VIOLET COLORS IN THE POSITIVE PROOFS,

TRANSLATED FROM THE FRENCH.

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THE

COLLODION PROCESS.

PART I.

THE great and increasing interest now so generally taken in Photography, particularly in the most recent and beautiful process of all, that by Collodion, has induced the writer to give such directions as he trusts will enable those who desire to practise this fascinating and useful art, to obtain, with great ease and certainty, most beautiful pictures; capable of multiplication to an unlimited extent, and of surpassing delicacy and truth.

The many and perplexing difficulties he himself experienced at the outset, owing more to a want of knowledge of the particular manipulation required, than to any other cause, lead him to hope that this little pamphlet will be found of service in supplying the want so many must feel, of somebody to tell them when, and how, to proceed.

He would not be understood as claiming the merit of originating the whole course of manipulation here given, as being most conducive to success; for from the progressive nature of the subject, he has been obliged to avail himself largely of the labors of others who have bestowed much time and attention upon it; all that he has attempted to do, has been to give in their plainest form, and in good faith, those methods which a course of careful experi-

ments, and successful practice, pursued for some time past, has enabled him to point out as reducing the Collodion process to a state of almost absolute certainty.

Should any one be inclined however to find fault with the manner in which apparently trifling details are dwelt upon, he is reminded, that it is by following and applying the directions given with care, that even those who have had no experience can obtain good results; while those who neglect them as unnecessary, throw discredit upon their pursuit and upon themselves by their failures.

The agent by means of which, from its sensitiveness, and rapidity of action, when properly charged with certain salts of silver; so many are now able to produce good effects, when almost all others are useless, has not been long known to chemists. It is a solution of gun cotton in alcoholized æther, and as some, from various circumstances, may not be able to procure it ready-made, the following directions for its preparation will perhaps be useful.

First prepare the cotton in the following manner.—Powder coarsely eight ounces of nitrate of potash, and after placing it in a basin, pour upon it one pound of common sulphuric acid, and then when it has been stirred with a glass rod, immerse in it without delay, by the same means, a quarter of an ounce of clean carded cotton, by small portions at a time, taking care that the whole is thoroughly and intimately mixed together. When it has remained at rest ten minutes, remove the cotton by means of the glass rods into a large vessel of water, and by stirring it about briskly, and renewing the water repeatedly, until it has no perceptible taste, wash out the whole of the acid and every thing soluble, then wring it in a cloth and dry it, either on a hot-water plate, or by hanging it up in a net where it can be exposed to a current of air.

The cotton must always be prepared out of doors, or in some place where the acid fumes (which are copiously generated) can be immediately carried off. The hands by coming into contact with the mixture would be stained

yellow, glass rods should always therefore be used. The smallest quantity falling on to any article of dress would produce a hole in a short time, and even the first two or three waters in which the cotton is washed, would stain, and in time destroy, any thing upon which they may be splashed: on this account the whole of the water used should be thrown away as soon as it is done with.

Paper made from linen rags is now very generally substituted for cotton, as being more easy to prepare, and as yielding a better film upon the glass. It is treated in precisely the same manner, and is used in the same proportions. To prepare the Collodion, seven ounces, by measure, of pure æther are to be mixed with one ounce, by measure, of strong alcohol, then add fifty grains of the prepared cotton or paper, and after shaking it, let it stand undisturbed to clear. If the cotton has been carefully prepared, it should dissolve quickly and leave little or no residue.

To iodize this and render it fit for photographic use, many methods have been proposed, from which the following has been selected as being most practicable. Place an ounce of alcohol in a stoppered bottle and add to it twenty grains of iodide of silver, then to the mixture add iodide of potassium in powder, until the whole of the silver is taken up, this will require some time unless it is conconstantly shaken. It is advisable to add the iodide of potassium in excess, and as the alcohol cannot take up too much, it may be allowed to remain some time after the iodide of silver is dissolved. The clear solution should be poured off from any sediment into another bottle for use. Of this, twenty drops are to be added to each measured ounce of the plain collodion, and after shaking, it is to be set aside for twenty-four hours to clear.

Collodion prepared in the foregoing manner will, if the æther and the alcohol are pure, form a very tough and adhesive film, but the action of the bath will be slow, in which case alcohol must be added carefully, until by coating a slip of glass, and immersing it in the sensitive bath, it is found to lose its transparency quickly. As

much alcohol as the collodion can bear without losing its tenacity should always be added, the action of the bath being rendered both quicker and more equal by its addition; if, however, too much is used, the film is likely to break and leave the glass.

Before proceeding to the consideration of the process in detail, it may be useful to give the following list of solutions as being necessary for the production of negative pictures.

1st	Nitrate of silver	40 grains.
	Alcohol	25 minims.
	Distilled water	1 ounce.

This is called the sensitive bath, and must be prepared in quantity proportioned to the size of the plates.

2nd	Pyrogallic acid	6 grains.
	Glacial acetic acid . . .	50 minims.
	Distilled water	8 ounces.

This is called the developing solution.

3rd	Nitrate of silver	40 grains.
	Distilled water	1 ounce,

This is to add to the preceding developing solution when it is used.

4th	Hyposulphite of soda .	10 ounces.
	Water	1 pint.

This is called the fixing solution, and can be made with ordinary filtered water.

All these solutions must be carefully filtered through bibulous paper before they are used, and should always be preserved in stoppered bottles. Distilled water need only be used for those for which it is especially mentioned. All the washing required may be performed with ordinary filtered water.

The first thing we have to attend to, is the

Preparation of the Glass for the Reception of the Collodion.

The best patent plate, free from scratches, should be chosen; and after having the squares cut to the size of the camera frame, the edges should be roughly ground, not only to protect the hands from injury, but also to render the adhesion of the film of collodion to the glass more perfect, a consideration of some importance; for when this precaution is neglected, it frequently happens that good pictures are torn and destroyed by the washing required in a subsequent part of the process.

All the articles necessary for cleaning the glasses are a few linen cloths, a couple of wash-leathers, an old piece of cambric, a small quantity of liquid ammonia diluted with an equal bulk of water, and some nitric acid diluted in the proportion of two parts of water to one of acid.

The cloths and leathers should be scrupulously cleansed from all impurities; the cloths by washing in a hot solution of common soda, and then rinsing several times in cold water; the leathers by soaking for a few hours in a *cold* solution of soda, and then rinsing as directed for the cloths, care being taken to avoid the contact of soap, as grease itself is not more injurious. When thus prepared they should be carefully kept from those used in wiping the frames, etc., and should not be used for any other purpose than the one for which they are first appropriated. In fact it is impossible to pay too much attention to cleanliness in any stage of this delicate process.

The best method of cleaning the glasses is the following:—

A small quantity of the dilute ammonia is to be poured upon the plate, and well rubbed over the surface with a tuft of cotton; then rinse it in clean water, dry it with one of the prepared cloths before it has had time to dry spontaneously, and with one of the leathers polish both sides thoroughly, holding the glass in the leather so that the hand may not come in contact with it.

For small glasses, the method just given, and which is the one generally followed, is the most practicable; but

when large, they are frequently broken by the force exercised in polishing them; to obviate this danger and to enable the operation to be performed much more thoroughly, one of the leathers should be spread on a table or any flat surface, and the glass laid upon it while it is polished with the other.

When working for positives with the iron solutions, greater care is required in cleaning the glass, especially after having taken a picture by that process: the stains left upon it by their use adhering sometimes with such tenacity as scarcely to be affected by ammonia. The method adopted by the writer, and found uniformly successful, has been, after removing the collodion, to pour upon the surface of the glass a small quantity of the dilute nitric acid, rub it well over with a tuft of cotton, and finish as when using ammonia.

After having taken a picture by the pyro-gallic process, neither the ammonia nor the nitric acid are required; simple washing with water being all that is necessary.

The glass, with the exception of removing any particles of dust (which would produce spots) with the piece of cambric immediately before using it, is now ready for the

Application of the Collodion.

This operation, influencing so materially as it does, by the manner of its performance, the character of the finished picture, is so purely a matter of delicate manipulation, that although very easy in practice to those who have once seen it done, is like most things requiring manual skill, much more difficult to teach by precept than example: and although in the following directions, the writer has endeavoured to render intelligible to the beginner the method he has found the best, he would nevertheless advise those who have the opportunity, to get a little "viva voce" instruction from a friend, as they will be sure to save both time and collodion by doing so.

Hold the glass horizontally in the left hand by one of its corners, and pour the collodion on to the centre, using a quantity sufficiently great to spread easily over the whole

surface, by slightly inclining the plate from side to side. When it is perfectly covered, return into the bottle by the same end as that held, all the superfluous collodion, raising the glass steadily, without haste, and bringing it at last from a diagonal to a vertical position, so that the lines formed by the draining, may run into each other, and leave an even surface. It is better to drain the collodion off the plate at the same end as that at which it is held; for by that means any impurities happening to be upon the fingers are retained at the edge, and do not traverse and stain the film.

A frequent cause of failure, is the presence of small pieces of dry collodion on the neck of the bottle; these should be carefully removed, for when suffered to remain, they are carried by the collodion on to the plate, and there being partially dissolved, cause large striæ, which inevitably spoil the picture.

Another precaution necessary, is to preserve the collodion in a large bottle, and decant into a smaller one a short time before using it, the quantity required for coating only a small number of plates. By this means the presence of the deposit which often forms at the bottom of the bottle is avoided, and with it, the spots upon the picture which it causes.

The operator must not immerse the plate in the sensitive bath until the collodion begins to set. The time to be allowed for this to take place, varies so much with the age and make of the collodion, and the heat of the atmosphere, that no rule can be given; he will soon however be able to judge if the æther has sufficiently evaporated. Some collodion, after resting a short time upon the plate, assumes a slightly opaque appearance; when it does so, it offers the best criterion for its immersion; the time for that being when the opacity first shows itself.

The writer has not recommended the employment of india-rubber, or gutta-percha as supports, by attaching handles of those substances to the glasses; they being but insecure and troublesome substitutes for the fingers, and require the expenditure of much valuable time before

they can be safely used; but in case of the plates being too large and heavy for the fingers to hold unaided, it is a great assistance to have a piece of wood six or eight inches high, turned with a broad, firm base, so as to stand steadily on a table, having at the top a flattened knob about two inches in diameter. This knob is to be covered with several folds of flannel, and over that a piece of sheet india-rubber or kid is tied, forming an effectual support, with sufficient adhesive power to prevent the glasses slipping when it is used. It will be found that by holding the glass by one of its corners in the usual manner, and resting it at its centre on this support, the manipulation will be as easy after a little practice, with large, as with small glasses.

All the process hitherto given may be performed by daylight, but in every subsequent operation, until the picture is fixed; the greatest care should be taken to exclude even the faintest ray of white light, except that which acts upon the plate in the camera. The most practicable way of doing this, is to cover the windows of the operating room with two or three folds of yellow calico, light, passing through a yellow medium, having little or no chemical effect. If this method cannot be adopted, the room must be carefully darkened, and a candle or small lamp used; but even these, unless protected by a yellow glass screen, should be kept at a distance from the plate.

Should the operator find it necessary to coat the plate by the light of a candle, he must be careful not to approach it too nearly when doing so; the vapour of the æther contained in the collodion being highly inflammable. This caution deserves attention; several instances of severe accidents happening from its neglect, having come to the knowledge of the writer.

We have now to consider the preparation and application of the sensitive bath for

Exciting the Plate.

The proportions generally employed and recommended by the most practised manipulators, are

Nitrate of silver	30 grains.
Distilled water	1 ounce.

Those used by the writer with great success for the last four months, have been the following :—

Nitrate of silver	40 grains.
Alcohol	25 minims.
Distilled water	1 ounce.

Dissolve the nitrate of silver in the water, add the alcohol, then filter through bibulous paper, and when not in use, preserve in a stoppered bottle, which it is as well to keep from a strong light.

For applying this solution, nothing is so convenient as an upright gutta-percha bath with a glass dipper, for not only is the immersion more easily performed, but from the small portion of the contents exposed to the air, they are preserved much longer in a uniform condition than when a horizontal one is used. After returning the solution into the bottle, this should always be well rinsed several times by filling it with water and shaking it, then stand it on end to drain.

The large proportion of silver, and the addition of alcohol, increase the sensitiveness of the plate considerably; and have also been found to assist in giving greater brilliancy to positive pictures, when the iron solutions are used in developing.

With a new bath, especially when a large proportion of silver is employed, it is frequently observed, that only an imperfect coating of iodide is formed on immersing the plate; this is attributed to the silver attacking and partially dissolving the film first deposited. The remedy proposed, is to add to the bath a few drops of a solution of iodide of potassium, which will cause the precipitation of iodide of silver; it is then to be well shaken, and allowed to remain at rest for a few hours, so that it may have time to take up its full dose of the precipitate, then filter carefully through paper.

The writer has found, if the bath is perfectly saturated, as it would be when treated as above directed, that

although a very dense film can be obtained, it has a great tendency to become spotted; to avoid which, he has generally, before adding the iodide, removed about an eighth of the bath, which is again added to the rest after having separated the excess of iodide by filtration.

The quantity of this solution required, varies of course with the capacity of the bath and the size of the plate, but it is good economy to prepare a few ounces more than actually necessary for filling it, as after using the solution it may be returned into the bottle, when any sediment contained in it will subside, and allow the clear upper portion to be decanted each time that it is wanted; thus avoiding the loss occasioned by filtering frequently; the quantity absorbed by the paper, and consequently lost, being considerable.

If, from long and frequent use, the bath should be exhausted, and fail in giving readily a film of iodide when the plate is immersed, it should not be thrown away; the addition of a strong solution of nitrate of silver (of course only in proportion to the *quantity* of the bath) will immediately restore it. An old bath often gives better negative pictures than a new one.

It may be as well here to mention, that when the temperature of the operating room is below 60° Fahr. the action of the bath is much improved by placing the bottle containing it in front of a fire, or into a basin of warm (not hot) water, before using it.

When the collodion, as before mentioned, has slightly set, the coated glass is to be rested on the dipper and immersed by one steady movement, without any pause; for the operator will find to his chagrin, that every check will produce lines which appear painfully distinct on every proof that it yields. The dipper, before placing the glass upon it, should be plunged into the bath for a moment, the moisture that it retains being of service in promoting an amount of capillary attraction sufficient to prevent the glass from falling.

The proper time to allow for the plate to remain in the bath, cannot be stated with precision; it is necessary, however, as practised by most operators, to leave it un-

disturbed for about a minute; it may then with advantage be lifted out from time to time, to ascertain the state of the film. *When the oily appearance caused by the ether gives place to a surface over which the solution flows freely and evenly*, the plate is ready for the camera. No harm is likely to be done by allowing an excess of time in this part of the process, as the film is not injured by a prolonged immersion when the bath has been prepared with the iodide as before recommended.

If, from want of practise in the manipulation, or from the collodion not having sufficient tenacity, it should leave the plate on immersing it in the bath, or break up in any subsequent operation; it may be improved by placing half in a bottle containing some pieces of thin sheet gutta-percha, allowing it to remain about twelve hours, and then again mixing it with the rest of the collodion. It will take up sufficient of the gutta-percha to enable it to be treated very roughly without any risk of injury: but as it renders the collodion slightly opaque when dry, it is unfit for positives.

When the plate is removed from the bath, all excess of liquid should be drained from it; and after doing so, it is advisable to wipe the uncoated side of the glass with a piece of clean linen, and also to place small pieces of bibulous paper at the corners of the plate frame, before inserting the glass, for the purpose of absorbing any liquid that may still drain from it. When thus treated, the plates are much less likely to stain, and the camera can be kept drier and cleaner.

Since the foregoing was written, the writer had occasion to use a new sensitive bath; upon preparing a plate in which, he found that the film blackened all over shortly after the application of the developing fluid. He had frequently heard of the same thing happening to others, but as it had never occurred to him before, it led to the following experiments.—An old bath, that was yielding good pictures, was tested with litmus paper, and gave *an acid reaction*. The new one when tested in the same manner was found neutral. He then added to the new bath about a fortieth part of nitric acid, and when a plate

was prepared with it, *it stood the action of the developing solution perfectly,* but its sensitiveness was impaired. He then added ammonia until the acid was neutralized and it gave an alkaline reaction; a plate was then prepared and exposed, but directly the developing fluid touched the film, it was *intensely blackened.* Again nitric acid was added to the same bath, until litmus paper was slightly reddened, and the plate prepared with it *stood the action of the developing fluid, and gave a good picture.* Another new bath was tried, found neutral, and the film it gave *blackened*; *two* drops of nitric* acid were added, and the plate then prepared, *stood the action of the developing fluid perfectly, and gave a good picture.*

From these experiments it appears, that when a sensitive bath gives dirty pictures with all times of exposure, the addition of a small quantity of nitric acid will correct the fault—a result fully borne out by subsequent experience.

It was noticed that the blackening did not take place to the same extent with old as with new Collodion. This the writer attributes to the presence of free iodine, which is generally set free by age; and being uncombined when it unites with the silver in the bath, a very small quantity of acid is liberated, which protects the film in the same manner as when added directly to the bath.

The injurious action of an alkali when present, even in minute quantity, was also accidentally shown in the following manner:—

A picture had been taken which developed properly, but upon cleaning and preparing another glass, the film blackened all over, as did two or three more; it then occurred to the writer that the blackness was owing to the absorbtion of ammonia, which had been rather freely used for cleaning the glasses, and as the operating room was small, sufficient must have remained to be taken up by the plates; this was proved by carefully ventilating the room, and then preparing another plate which behaved well in developing.

* The capacity of the bath was 16 ounces.

For the above reason it is recommended that the glasses should not be cleaned in the same room as that used for coating them, unless it is large and well ventilated.

In this, and the following operation, stains are often produced upon the hands by the nitrate of silver; these may, if recent, be removed (much more safely than by cyanide of potassium) by first brushing them over with a saturated solution of iodide of potassium, and then with nitric acid, diluted so as not to stain the hands yellow, that is to say, with twice its quantity of water. The iodide does not itself entirely remove the stains, but directly the nitric acid is applied they disappear.

Both the solution of iodide and the nitric acid should be kept ready for use.

Exposure of the Plate.

The plate after being rendered sensitive by the last operation, is to be submitted to the action of light in the camera, with as little delay as possible. The time of exposure necessary for obtaining perfect results, varies so constantly with the intensity of the light, the state of the collodion, and the power of the lens, that no rule applicable to all cases can be given; and the operator will find he must here depend on experience as his guide, for *it is only by the behaviour of the plate under the action of the developing solution,* that he can judge if the exposure has been of the proper duration; and he should, as soon as possible, make himself sufficiently acquainted with the appearance of the film, both when over and under exposed, to be able to correct at once any error he may be guilty of under this head.

The difference in the power of light according to the season, time of day, &c., almost all are acquainted with; but as the change produced on collodion is not so apparent, one of the many instances which have occurred to the writer, of the influence of time in impairing its sensitiveness may be given. He took on the same day, as nearly as possible at the same time, two pictures; to one of which he gave two seconds' exposure, to the other forty seconds, and in both cases the results were equally good.

Now, the only difference in the preparation of these glasses was, that for the first, collodion three days old was used, while that used for the second, had been made more than six weeks. It is necessary to add that both samples of collodion were prepared in the same manner, and from the same chemicals. The writer is aware that the above instance is an extreme one and that collodion is now sold in London much more permanent than that used by him at the time. It is, however, unfortunate: that while collodion, containing a large proportion of *silver* is more readily acted upon in the bath, and produces better negative pictures; that it should be so much more liable to a loss of sensitiveness, than when simply iodized. As a general rule, it may be noticed that *new collodion is rapid in action, but deficient in power, and that age, in diminishing its rapidity adds greatly to the intensity of the pictures it is capable of producing.*

When the operator has had no experience in the working of his collodion, he will save both time and materials, if in the first instance he takes two pictures; giving to the first, if the light is tolerably good, from four to five seconds exposure, and to the other from thirty to forty. The difference of their appearance after, and while developing, will be the best guide to the time to be allowed in any future trials.

With regard to placing the sitter so as to have the light properly disposed, so much must depend upon the taste and artistic skill of the operator that our remarks are necessarily brief.

It is generally of advantage to have one side of the face rather more illuminated than the other, at the same time having the light tolerably diffused; and to avoid the reflection of too much from the ground by covering it with any dark material.

In summer, or when the weather is mild, it is better to work out of doors, in which case, from the great rapidity of action, much more natural and pleasing portraits can be taken than even in a glass room.

When, however, an ordinary sitting room has to be used, white drapery and screens should be placed about

the sitter, to reflect light, and to prevent the heaviness of appearance caused by its falling too much in one direction.

If the room has more than one window, the sitter must be placed so that the light from only one may fall upon the eyes; for if it reaches them from more, it gives an unpleasant appearance of blindness by causing a double reflection.

We have now to consider the

Developing the Picture.

For certainty and uniformity of result, nothing has yet been found so applicable to this purpose as pyro-gallic acid when used in the proper manner; and it is to those gentlemen who first advised a departure from the old three-grain solution, that the thanks of all who practise this beautiful process are due, for the success which now so generally attends their efforts.

The developing solution is made as follows.—

Pyro-gallic acid	6 grains.
Glacial acetic acid	50 minims.
Distilled water	8 ounces.

Mix and filter through bibulous paper.

The plate having been removed into the operating room in the camera frame, is to be placed quickly and carefully on the levelling stand, which should be previously adjusted by screws to a horizontal position, and a quantity of the preceding solution having been measured into a clean glass,* a solution of nitrate of silver, forty grains to the ounce, is to be added to it, in the proportion of two drops to each dram. When these have been mixed by stirring with a clean glass rod, they are to be poured quickly over the plate, (taking care not to disturb the film) by moving the hand holding the measure in a

* A glass 3 by 4 inches requires 2 drams.
Ditto 4 „ 5 „ 4 „
Ditto 5 „ 6 „ 7 „
And large sizes in in proportion.

circular manner, so as to disperse the contents rapidly over the surface; which dispersion may be also much assisted by blowing upon the glass with the mouth; this not only has the effect of rendering the application more equal, but serves to keep in suspension the deposit which generally forms. The operator must not blow too long in one place, nor with sufficient force to remove the fluid entirely from any part of the plate; cloudy, dirty marks, being often produced by so doing; another cause of unequal development is neglecting to mix the pyro-gallic and silver solutions together with adequate care.

As soon as the fluid is applied to the glass, the operator should watch the progress of development with the utmost attention, for as before said, it is upon a knowledge of the appearance presented by the film of Collodion, both when under and over exposed, that the beginner can ascertain the time for allowing the plate to be acted upon by light.

He must, from time to time, by holding a piece of white paper under the glass, or, if practicable, by looking up through it, observe the amount of intensity he has obtained, taking the following remarks for his guide, (until he has had experience) as to the time for arresting the action of the developing solution.

If, upon pouring on the solution, the image appears tardily, and the high lights upon the forehead, &c., attain great intensity before the details of the dress are visible; and if, after removing the iodide by the hyposulphite, it exhibits a greyish appearance by reflected, and a perfectly opaque deposit in the high lights by transmitted light; *it has been under-exposed.*

If on the contrary the picture appears quickly, the shadows coming out nearly at the same time as the lighter parts; and if, after a time, it begins to change all over; and lastly, if upon removing the iodide, no picture is visible by reflected, and only a faint one by transmitted light; *it has been over-exposed.* The great want of contrast in over-exposed pictures is worthy of remark; the folds of the shirt, and of the coat, being scarcely distinguishable, by their intensity, from each other.

But if upon developing, first the lights, and immediately afterwards, the shadows of the face, followed by the dress of the sitter make their appearance; the deep shadows under the arms, &c., preserving their original clearness, while the lights go on increasing in power; and after using the hyposulphite, it exhibits a bloom upon its surface, the principal lines being clearly seen when it is looked down upon, and when looked through, all the different parts of the picture are shown in their proper gradation of power; *it has had the right exposure.*

Although the characteristics of a negative that has been properly exposed are those above given; a considerable range of time may be allowed on either side, without producing an utterly useless picture.

At the risk of repetition, a few useful hints on this subject may be given in conclusion.

If the plate has not been much under-exposed, a good picture may be often had, if the fluid is not allowed to remain on long enough to render the whites perfectly opaque.

If it has been over-exposed, it is of very little use trying to increase the intensity of the picture by continuing the action of the developing fluid, after it has begun to blacken equally.

When properly exposed, the action may be continued until the whole of the details are clearly shown; taking care not to allow the whites to gain too much strength.

When the development has proceeded far enough, the plate is to be removed from the stand, and washed by pouring a gentle stream of water upon its surface while it is held horizontally. This operation requires care, for if the water is poured from too great a height, or if the plate is too much inclined, the collodion will be torn from it; but if *common care* is exercised, this accident is not likely to happen.

After washing, the plate is to be returned to the stand, and the following solution is to be poured on in quantity sufficient to cover it perfectly.

Hyposulphite of soda	10 ounces.
Water	1 pint.

This application renders the plate insensitive to the action of light, and quickly dissolves the yellow iodide; while doing so, the negative picture seems gradually to disappear, and then, if it has been well developed, to re-appear as a positive. It is important that the hyposulphite should be left on long enough to dissolve the whole of the iodide, for if not completely removed at first, it will cause an otherwise good negative to be perfectly useless; the collodion seldom being able to bear a second application of the hyposulphite after it has once dried.

When the plate appears quite clean and free from veined markings, it is again to be thoroughly washed to remove every trace of the hyposulphite from it; for if from this being carelessly done any should remain, it will after a time crystallize and destroy the film.

The picture, after being drained, and then dried, by holding it at a short distance from a fire, or placing it in a draught of air, is finished; and may be printed from immediately; it is better, however, to protect it previously with a coating of varnish or gum arabic.

When gum arabic is used, it should be dissolved in water, in sufficient quantity to flow easily over the plate when applied, as it should be, in the same manner as collodion; when all that is superfluous has drained away it should be placed horizontally to dry in a place free from dust. The use of gum arabic is mentioned on account of its being at hand sometimes when varnish or lacquer is not to be had, but it should never be used in preference to them, as it is little or no protection from damp, and may break up the film.

Mastic varnish diluted with twice its bulk of turpentine, answers very well, as it is easy to apply, and does not readily change colour; but it has the disadvantage of taking some time to dry.

The best of all is the spirit varnish recommended by Mr. Horne, as the negative can be printed from immediately after coating it; the only objection to its use being the difficulty found by some in its application. The plate must be held before a fire until it is as hot as

the hand can bear, the varnish is then poured on and drained off again into the bottle, in the same way as when coating with collodion; if the glass is thin and cools rapidly, it is again to be held before the fire for a few moments, to keep up the heat until the spirit has all evaporated, for when the plate is allowed to cool before the spirit has left it; instead of a hard, bright, glassy surface, only a dull, rough one is obtained.

The glass having been protected in either of the preceding ways, is ready for

Printing, or Transferring to Paper.

The apparatus required for this need be neither complicated nor expensive; all that is actually necessary being comprised in the following list:—

A few pieces of stout plate glass, rather larger than the pictures they are to be used in printing—some plain —others having smooth black cloth evenly pasted over one of their surfaces.

Some drawing boards on which to pin the paper when the solutions are brushed over.

Some square flat dishes for applying the solutions when floating is preferred to brushing.

Some silver pins.

Two or three brushes made expressly for photographic purposes.

Some dishes for washing the proofs after fixing them.

Bibulous paper.

When a sheet of paper has been rendered sensitive by either of the following means, it is to be laid, the prepared side up, on one of the covered glasses; the Collodion negative is to be carefully placed, the coated side downwards, upon it; and then upon that, one of the plain pieces of plate glass; the weight of which will be sufficient to bring the negative into close contact with the paper. After having done this in a moderately dark room, remove it to where the light of the sun, or even diffused daylight, can have free access to it; for a time varying with the force of the negative and intensity of the light, until it is dark enough. It may be safely

looked at, by first carefully taking off the upper glass, and then while one end of the negative is pressed firmly on to the paper to prevent its slipping, the other is lifted just high enough to allow the progress of the picture to be seen. If it is not dark enough, the glass must be lowered down and it must be again exposed to light.

Some difficulty may be found at first in returning the glass to precisely the same place it before occupied on the paper; a little practice will, however, soon enable the operator to do it successfully; and as so much of the beauty of the proof depends upon its having the proper amount of light, he must frequently inspect its progress; he will therefore do well to master this piece of manipulation as soon as possible.

The proof should always remain in the light until it is considerably darker than it is desired to be when finished, to allow for the loss of power it always sustains in the hyposulphite bath; and it should be borne in mind that an under-printed picture cannot be improved, while one that is over-printed can, by prolonging the action of the hyposulphite, be reduced to almost any extent.

There are several ways of applying the solution to the paper, those most generally practised being either by the brush, or by floating the paper on a quantity of the solution.

When the use of the brush is preferred, a piece of the paper to be prepared should be pinned by its corners to a smooth drawing board, having previously placed a piece of white blotting paper, somewhat larger, beneath it, to absorb any of the solution that may pass over the edges.

When the paper has been pinned on to the board, the solution is to be brushed freely over it, first in one direction then in the other, so as to ensure an even coating; when it is so absorbed as not to run from place to place on inclining the paper, it is either to be dried spontaneously, or, which is much better, by placing it before a fire.

If the operator prefers floating the paper, he will require a larger quantity of the solutions; they must be poured into a flat dish to the depth of about a quarter of

an inch, and then the paper, cut to the proper size, is to be floated, by first placing one end on the fluid, while the corners of the other end are held in the fingers, bringing the whole gradually down upon it, and exercising sufficient pressure to prevent any air bubbles from remaining. When the ends cease to curl up (generally after one or two minutes) it is to be taken up, and pinned by a corner to the edge of a shelf or table, then, to facilitate the draining, attach a small strip of blotting paper to the corner from which the liquid drops. It is to remain suspended until dry.

A very good paper may be prepared with the following solutions, taking care to dry it thoroughly after each application. First

Hydrochlorate of Ammonia . .	10 grains
Distilled Water	1 ounce

This solution may be applied indifferently to French and English paper, but the same strength of silver solution will not answer equally well for both. When Canson's positive paper (which is the best) is used, it must be at least of the following strength:

Nitrate of Silver . . :	80 grains
Distilled Water	1 ounce

While for Turner's, Whatman's, and most other English makers, the following will be strong enough:

Nitrate of Silver	60 grains
Distilled Water	1 ounce

The silver solutions, to ensure uniformity of result, should be applied in the same manner as the chloride, that is to say, either floated or brushed, as that has been.

Another good preparation is the following: First

Hydroclorate of Ammonia . .	4 grains
Distilled Water	1 ounce

Next a fifty grain solution of ammonio-nitrate of silver, which may be made as follows: Dissolve fifty grains of nitrate of silver in an ounce of distilled water placed

in a two ounce bottle; when it has perfectly dissolved, add a solution of ammonia, drop by drop; this will at first cause it to become quite turbid, but by continuing to add the ammonia it will once more become clear. No more ammonia should be added than is just sufficient to redissolve the precipitate, and to be certain that no excess of ammonia is present, a small quantity of a fresh fifty grain solution of nitrate of silver is to be added, until it is again very slightly turbid. After the bottle has remained at rest for an hour or two, the solution will clear and be ready for use.

Both of the preparations here given produce very beautiful colours, but as glass negatives differ so much more from each other than those on paper, the same tint cannot so certainly be secured.

The following solution for fixing the proofs must also be prepared:

Hyposulphite of Soda	5 ounces
Water	1 pint

After the hyposulphite has dissolved, seventy grains of nitrate of silver are to be separately dissolved in an ounce of distilled water and poured into the hyposulphite solution in a small stream, while it is stirred with a glass rod.

When the proof has remained in the light for a sufficient time, it is to be removed from beneath the negative, and plunged completely into the preceding solution of hyposulphite, and there allowed to remain about half-an-hour. It is then to be dipped into tepid, and after a few minutes into boiling water, which is to be drained off and renewed four or five times, and then it is to soak in a vessel of water for an hour.

When the hyposulphite has been thus removed, the proof is to be partially dried between folds of white blotting paper, and before it is *quite* dry, ironed with a moderately hot iron, previously placing it between two sheets of smooth paper, and it will be finished.

The preceding directions for printing have been much condensed, but even so little would not have been said,

were it not that some may object to the extra trouble which attends the method of M. Le Gray, a translation of whose new and very beautiful process of fixing by the use of chloride of gold and muriatic acid, forms part of the present publication.

All that has been hitherto said refers principally to negative pictures, which have but little beauty until they are printed from. What we have now to consider is the production of positives, or pictures that can be seen directly upon the glass.

Some positives that have been produced, exceed the daguerreotype in beauty, and equal it in definition, while they are free from most of the glare inseparable from the use of silver plates.

We will begin with the method most nearly approaching that for negatives, merely premising that in all cases the glass is coated and excited in the same manner for both.

Mr. Horne, some time since, stated, that by the addition of one or two drops of nitric acid to the ordinary pyrogallic developing solution, very good positives could be obtained, and although a perfectly bright deposit is not given, it is still the most simple process in its application. The nitric acid must be carefully added, for if too much is used the formation of a deposit is prevented.

A correspondent of the Mechanic's Journal, in the number for December, 1851, published the following formula, which is here given as having yielded the writer some of the whitest pictures he has seen.

Proto-sulphate of iron	12 grains.
Nitric acid	1 or 2 drops.
Distilled water	1 ounce.

If the whites of the picture are not sufficiently bright, more nitric acid may he added.

The writer has lately used fifteen grains instead of twelve to the ounce with advantage; this may, however, be owing as much to a difference in the collodion as to the proportion of iron.

Another formula has lately been communicated to him as having produced very beautiful positives, it is the following :—

Proto-sulphate of iron	20 grains.
Acetic acid	1 dram.
Nitric acid	2 drops.
Water	1 ounce.

When using either of the above solutions, the plate must not be exposed in the camera more than half the time required for a pyro-gallic negative, and when the solution is applied it must be poured as gently as possible along the edge of the glass, and at the same time so as quickly to cover the whole surface, for if it is all poured on at one spot, the action of the nitric acid contained in it is so unequal, that an evenly developed picture cannot be had.

Soon after the picture begins to appear, and before the whole of it is visible, the developing solution must be poured off, it must be well washed with water, and then fixed with the same solution of hyposulphite as that used for negatives. When it is quite dry, it must be varnished to restore the transparency that it has lost in drying

It will often be found if sufficient exposure has not been given, that the picture develops slowly : when this is the case, instead of the blacks being pure and strong, a formation of small spangles of metallic silver takes place after a time equally over the plate, and of course spoils the picture. On the contrary, when over-exposed, the developing fluid acts so rapidly on the parts that have received most light that it has to be poured off before the half tones appear, in this case the blacks will be very strong and clear, but all definition will be lost in the lighter parts.

To Dr. Diamond we are indebted for a process by which very beautiful positives have been obtained. He first prepares a solution of proto-nitrate of iron in the following manner :—Powder 300 grains of nitrate of baryta and place it together with three ounces of water

in a glass vessel that will stand heat, over a spirit lamp, until the whole is dissolved. When the solution is complete, throw into it 320 grains of pure proto-sulphate of iron in crystals, which by stirring will dissolve, and there will be formed by mutual decomposition, a heavy white precipitate of sulphate of baryta which will soon subside, and proto-nitrate of iron which remains in solution and may be decanted off into a bottle for use.

After exposing the glass in the usual manner in the camera, and placing it upon the levelling stand, he recommends that a portion of the proto-nitrate of iron solution should be poured into a measure, and immediately before applying it, a small quantity of the ordinary pyro-gallic developing solution is to be added. The picture is to be developed with this mixture, and when of sufficient strength, it is to be washed off and the iodide is to be removed with a strong solution of hyposulphite of soda in the usual manner. He states that better colors can be obtained when hyposulphite that has been already used is employed, and that instead of throwing it away when it is exhausted, a few crystals of hyposulphite should be added to renew it.

The proto-nitrate solution will not keep for any length of time; only a small quantity should therefore be prepared at once, but if more than can be used is made, it must be preserved in a bottle that it entirely fills, for if any space is left, the air contained in it will impart oxygen to the *proto*-nitrate, and render it useless by converting it into the *per*-nitrate.

The following process by M. Martin has also been much recommended.

He uses, instead of the bath usually used for exciting the plate, one composed as follows:—

Nitrate of silver	40 grains.
Nitric acid	24 minims.
Distilled water	1 ounce.

After exposing in the camera, he developes by immersion in a bath of pro-sulphate of iron, and when sufficiently

brought out, he washes it thoroughly with water and then immerses in another bath composed of

Nitrate of silver	12 grains.
Cyanide of potassium	77 grains.
Distilled water	7 ounces.

which will convert the negative picture into a positive.

In concluding this attempt at rendering the Collodion process more generally available than it has been, the writer trusts that nothing has been forgotten that can assist in helping the beginner over the difficulties that generally beset a new pursuit, he has at the same time to acknowledge the great kindness and ready assistance he has received when in want of information while himself but a beginner, and if he has here only partially succeeded in supplying to others the place of the friendship he has always found, he will not think his task a useless one.

PART II.

A METHOD OF PROCURING

BLACK AND VIOLET COLORS

IN THE

POSITIVE PROOFS,

AND OF

MORE PERMANENTLY FIXING THEM

BY THE USE OF

CHLORIDE OF GOLD AND HYDROCHLORIC ACID.

BY

GUSTAVE LE GRAY.

TRANSLATED FROM THE FRENCH.

SOME APOLOGY MAY BE NECESSARY FOR PUBLISHING THE FIRST FEW PARAGRAPHS OF THE FOLLOWING WORK AS THEY HAVE BEEN ALREADY TRANSLATED, BUT INDEPENDENTLY OF THEIR BEING VALUABLE IN THEMSELVES THEY ARE SO CLOSELY CONNECTED WITH THE MORE RECENT PART OF THE PROCESS, THAT IT WAS NOT THOUGHT DESIRABLE TO OMIT THEM.

PART II.

Preparation of Positive Paper.

First prepare the following solution :—

Hydrochlorate of Ammonia .	5 grains.
Distilled water	100 „

Pour this into a flat dish to the depth of about a quarter of an inch.

Then make a solution of silver as follows :—

Nitrate of Silver	15 grains.
Distilled water	100 „

You put this into another dish of the same depth.

First float the paper on the chloride bath in such a way that the liquid shall only touch one side, and there leave it from two to four minutes ; then dry it between several leaves of blotting paper, rubbing it with the hand.

Prepare thus three sheets, before placing any on the nitrate bath, to insure their getting quite dry.

You then take the first prepared sheet and brush the salted side with a large and rather hard badger brush to remove all impurities.

Then put the salted side of this sheet on to the nitrate

bath, and let it remain while you prepare another sheet with the salt.

By leaving it a short time you obtain reddish tones, and by giving more time, the black tones.

Drain the paper and hang it up by a corner to dry.

This preparation should be done by candle light.

You must not prepare it more than a week before hand, as it will blacken by keeping, even in the dark.

When many proofs are to be taken, it is better to prepare a number of sheets with the salt beforehand, as they will keep any length of time, until the silver is applied.

In this case it is advisable not to put more than 4 grs. of salt to 100 in the first bath. The silver bath may be the same, but the paper must be used within a few hours of its preparation.

Positive Albumen Paper.

Albumen has been of much service in Photography in the preparation of positive paper, it gives a brilliancy and vigour not to be easily obtained by other means.

Take any quantity of the whites of eggs and to every 100 grains add 4 grains of hydrochlorate of ammonia, beat them to a froth, and decant the clear liquid after standing for a night.

You pour some of this into a dish, and prepare one side only of the paper by the method recommended for the last. Leave it two or three minutes, then dry it, and after placing it between two sheets of white paper, pass an iron sufficiently hot not to scorch over it.

Paper thus prepared is highly varnished; if you require less gloss, add, before beating the eggs, one half or more of distilled water containing in each 100 parts 5 of hydrochlorate of ammonia.

You place the albumenised side of the paper upon a nitrate of silver bath, 15 parts nitrate to 100 distilled water, and leave it to imbibe for four or five minutes. Hang it up by the corner to dry, and treat it as previously directed for the first positive paper.

Fixing the Positive Proof.

A proof thus obtained would not be permanent, it must therefore be fixed by the following operation :—

Dissolve in a bottle,

Hyposulphite of Soda . . .	100 grains.
Filtered Water	600 „

In another bottle dissolve 15 grains nitrate of silver in a glass or two of water. When it is dissolved, you add a saturated solution of chloride of sodium, till a precipitate no longer forms. Allow the precipitate to subside and then decant as much of the liquid as possible, and collect the precipitate, which you should place in a capsule, in the sun, taking care to stir it about with a glass rod, so that all may be thoroughly blackened. When this is done, you must put it into the hyposulphite solution, in which it will dissolve.

To fix a proof properly, it should not be less than an hour in the bath.

When the proof is the colour you desire, wash it several times in water, and at last let it soak two or three hours in a large quantity of water.

Then dry it, either by hanging it up, or, which is preferable, between sheets of blotting paper, and it is finished

It has been complained of by photographers that their best proofs fade, and even sometimes quite disappear. They notice this as occurring more particularly with the yellow and dark sepia colors.

Here I think they are in error, these colors being on the contrary the most lasting, when properly obtained.

The imperfect fixing of proofs is often caused by the ill-advised use of old hyposulphite, too much charged with salts of silver.

Having been one of the first to suggest the use of old hyposulphite for obtaining dark, rich tints, I will endeavour to point out the precautions necessary to be taken, to avoid the evils complained of.

The positive proof may be injured by two causes; either from the imperfect removal of the salts of silver

from the substance of the paper, or from sulphur, or hyposulphite being allowed to remain in it.

The first injury is caused by the proof remaining too short a time in the hyposulphite, which leaves chloride of silver in the paper, and the proof becomes darkened; also by the use of hyposulphite, which contains too large a quantity of the salts of silver previously obtained from other proofs. In this case, the hyposulphite loses its dissolving power, the chloride of silver, instead of being removed, is transformed into a double salt, which remains in the paper, and being partially insoluble, cannot be expelled by any washing. In these cases, the light parts of the picture will be dirty, and the dark soon fade.

The second injury is occasioned. In the first place, by the addition of acid to the hyposulphite, which immediately decomposes it, and liberates sulphur. In the second place, by immersing too many proofs at one time into the hyposulphite; the quantity of chloride and nitrate of silver contained in them bearing too great a relative proportion to that of the hyposulphite bath, there will be a separation of acid, the bath will be decomposed, and a deposit of sulphur formed on every proof.

In these two cases it will be seen that the proofs are stained and dull, and in time quite destroyed, the sulphur remaining in them acting upon the dark parts.

If the washings in water have not been sufficiently repeated, the proofs will retain some of the hyposulphite and will be equally affected by time.

Having stated the causes of failure, I will proceed to point out the best means of avoiding them.

Hyposulphite, precipitating the nitrate of silver, black, in the form of sulphuret, while on the contrary, entirely dissolving the chloride of silver, you should, before submitting a proof to its action, transform to the state of chloride all the free nitrate of silver which it contains. This may be done by immersing the proof in a very weak solution of hydrochloric acid, and then thoroughly washing it in several waters.

A positive proof should always be exposed to the light a sufficient time to allow of its remaining, at least one

hour, in a new hyposulphite bath, without losing any of the details.

The proof should be immediately put into a large vessel of water, and allowed to remain four hours, changing the water every hour, in order to expel the hyposulphite, which, if allowed to remain in the paper, would destroy the picture.

If still more permanency be desired, you may, after pressing the proofs between blotting paper to absorb the water, wash them with spirits of wine at 36° which will remove any sulphur that it might retain.

When old hyposulphite is used, which has already served for fixing proofs, and contains salts of silver in solution, care must be taken to remove the proof from the bath before it has been too much acted upon, and the fixing is to be completed by immersing it in a new hyposulphite bath, having previously left it for a minute in water. It is finished in the usual way, by repeated washings.

The salts of silver which remained in the proof under the influence of the old hyposulphite, are thus removed, which could not otherwise be entirely dissolved, and you obtain bright and lasting tones not to be affected by time.

By adopting these precautions, the proofs which I have obtained for the last three years have not altered, while those in which I have neglected them have mostly faded.

By all the means generally in use, except the modifications, I have here given, you can obtain very beautiful proofs of rich warm tones, but it is very difficult to secure a perfect black in the dark shades, and a pure white in the light ones of the proof.

Again, the light parts are almost always more acted upon than the dark, which gives the proof a solarized appearance.

By the following process I have succeeded in obtaining a pure black and white, a blue-black, a blue green, and pictures of a similar tint to india-paper proofs, at the same time preserving the white with a clearness and brilliancy not to be obtained by any former process.

But what photographers will most appreciate is, that by this process, the positive proof loses none of the details of the negative, nothing is solarized or lost, however great the contrast in the negative may be.

As for the durability of the proof, I believe it to be certain, from the very nature of the precipitate forming the blacks.

The following is the plan I adopt. My positive paper is prepared in the way previously directed, with hydrochlorate of ammonia and nitrate of silver. I expose the proof much longer to the light than when I fix it in the usual way.

When I wish for a blue black in the darkest parts, I allow the whites of the picture to assume a clear violet tint before removing it from the printing frame.

For a pure black, they should be allowed to reach a very decided violet.

For a green black, the whites should assume a sepia tone.

After exposing it to the light, I wash the proof in plain water, to remove all the free nitrate of silver. If however, the solutions used in the preparation of the positive paper be not too strong, this precaution is unnecessary.

Washed or not, I immerse the proofs in a bath made in the following manner, taking care to keep moving them about while in.

Distilled water	1000 grains.
Chloride of Gold	1 grain.
Hydrochloric Acid	25 grains.

The picture clears immediately after its immersion, the olive tints pass to black, and the light tones shade off, but are not injured.

When the blacks are perfectly clear, and all the details of the negative developed, I take the proof from the bath and wash it in five or six waters to remove all trace of acid.

It is of much importance that this washing should be done with the greatest care, otherwise there will be formed

a precipitate of sulphur in the proof, on submitting it afterwards to the action of the hyposulphite, which completes the fixing.

A first bath of water containing some liquid ammonia, effectually neutralises the acid, and prevents the precipitation of sulphur. Two washings in this case will suffice.

I then submit it to a hyposulphite bath, composed of one part hyposulphite to six of water. The hyposulphite changes the proofs of a blue tone to that of a black, without destroying any of the details—a prolonged action modifies the tone and causes it to pass through a series of shades, even to a green.

I never leave the proof less than half an hour in the hyposulphite bath that it may be well fixed, and I can leave it three or four hours without its losing any of its strength.

It is by modifying the time of the proof remaining in this bath, as well as in the first one of acid and gold, that I obtain the variety of shades and tones, which afford such remarkable richness to the picture.

I complete the fixing in the usual way, by repeated washings.

In using a bath containing chloride of silver instead of a new hyposulphite bath, you obtain still more brilliant tints, but in doing this, the proof must pass through a new hyposulphite bath before it undergoes the final washings in water.

The object of the chloride of gold bath is to precipate the gold upon the salts of silver, reduced by light. This precipitate on the contrary, not taking place upon the unchanged chloride of silver; consequently, the light parts of the proof remain pure, while the dark parts change to a violet black tint.